apparently the two outer planets were not much further advanced in development than Jupiter and Saturn, although their much smaller size would imply a shorter career and more rapid development; it therefore seems probable that the order of formation of the giant planets has been from the inside outwards, and not the reverse.

In the matter of the origin of the moon the author does not favour the idea of its separation from the earth by fission, holding that it grew from meteors captured in the outer portion of the extended nebulosity which represented the future earth. Throughout the book he postulates the action of resisting medium; many systems of cosmogony do the same.

A few errata may be noted. On p. 207 the author pours scorn on the suggestion that the comets of Tuttle and De Vico have any connexion with the planets Saturn and Neptune respectively; he overlooks the fact that while the inclinations of their orbits are 55° and 85° respectively, the inclinations of their major axes are much less, so that in each case a shift of the node by a few degrees would bring about intersection with the planetary orbit. In the tables of planetary elements he adopts for Venus the very doubtful rotation period of 68 hours, while he treats both the rotation time and the position of the axis of Uranus as unknown, whereas both are known within narrow limits.

It is of course unreasonable to expect a book on such a subject to settle definitely all the matters on which it treats. Viewing it as a setting forth of the problems presented by our system, with more or less plausible solutions, it makes interesting reading.

A. C. D. CROMMELIN.

Reservoir and Other Dams.

The Design and Construction of Dams: including Masonry, Earth, Rock-fill, Timber, and Steel Structures, also the Principal Types of Movable Dams. By E. Wegmann. Seventh edition, revised and enlarged. Pp. xvii + 555 + plates A-Z + plates AA-VV + plates I-III. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1922.) 50*s*. net.

MR. WEGMANN'S treatise has been before the public for so long that we imagine its general features will be more or less familiar to all who are engaged in the domain of waterworks engineering. The modest volume of 106 pages which appeared thirty-four years ago has, however, developed considerably in the course of time. It is now a ponderous tome of some 600 quarto pages of text, with well over 100 full-page plates in addition. A volume of such weighty proportions cannot fail to impress the reader in point of size alone, and it undoubtedly represents a considerable amount of patient toil in its compilation. It is, in fact, not merely a text-book; it is a work of reference, containing diagrams and particulars of most of the notable dams which have been constructed in recent years. It is permissible to the critic to question the wisdom of combining the two objects in a single volume. To the student, a text-book of modest proportions is a desideratum; he needs something easy to handle and conveniently portable, in the pocket if need be. The work of reference, on the other hand, is only required on occasion and may rest in the bookcase for long intervals. This combination of text-book with an exhaustive, or nearly exhaustive, record of existing examples is open to the objection that it meets the convenience neither of the student nor of the expert. However, we do not wish unduly to press the point.

In the seventh edition Mr. Wegmann has made his treatise replete with information of a highly valuable character. He has included a full description of the Kensico dam, New York; particulars of the movable dams of the New York State Barge Canal; and a brief notice of the Camarasa dam in Spain. This last is stated to be the highest gravity dam in the world, but surely the Arrowrock dam is higher by 20 ft. Probably what is meant is that the depth of water against the Camarasa dam is not equalled elsewhere. Why is the Arrowrock dam not included in the table of high masonry dams? Another very high dam omitted is the Hetch-Hetchy dam. There is, perhaps, some excuse for this omission, as the dam is yet under construction. Still, its dimensions are known and it is an important undertaking. A new chapter on crest gates and siphon spillways has been added, with particulars of examples built both in America and elsewhere, some of them of considerable size.

The subject of dams, of course, is wider than the sphere of waterworks engineering, although this is, perhaps, the most important field of its application. Mr. Wegmann's treatise covers dams as adapted to river engineering operations, and cofferdams as used in foundation work. Briefly, the volume consists of four parts, the first of which deals with the design and construction of masonry dams; the second, with earthen, rock-fill, timber, and steel dams; the third, with movable dams, cofferdams, and overflow weirs; and the fourth with recent dams of all classes. There is an appendix containing the specifications for the New Croton dam with various supplementary notes, a lengthy bibliography which, unfortunately, is not alphabetically arranged (the writer traced some works with difficulty, and failed to find mention of Mr. Powell Davis's book on irrigation works, which contains a

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good deal of information on dams), and a fairly full index.

Taken as a whole, the work undoubtedly maintains its high reputation as a standard authority on the subject of reservoir dam construction, and its wealth of diagrammatic profiles from existing examples will cause it to be of great value to the practising engineer, as well as to the student who is seeking to acquire a knowledge of first principles.

Brysson Cunningham.

Science and Progress.

Progress and Science: Essays in Criticism. By Robert Shafer. Pp. xii+243. (New Haven: Yale University Press; London: Oxford University Press, 1922.) 12*s.* net.

THIS volume is almost entirely critical, mainly of the doctrine that science has contributed to a more rapid " progress " of the human race as a whole, and that we may expect this progress to continue. Much of the criticism is acute and many other writers are cited—Prof. Bury, Mr. G. D. H. Cole, Mr. Tawney, and Miss Follett; but the main attack falls upon Mr. F. S. Marvin, whose books, " The Living Past " and " The Century of Hope," are largely quoted in the initial chapter, which gives its title to the whole; he is dismissed in the concluding sentence thus: " It follows that men such as Mr. Marvin are hardly doing us any good, are promoting rather beliefs and hopes which may in the end work an intolerable mischief in the world."

It is a challenge to optimism, or rather to meliorism, based on science, and would have more justification if the author could find any passage either in Mr. Marvin's writings, or in any sympathiser's, indicating a belief either that this progress was complete, or that it could be expected to continue without the strenuous efforts of mankind to carry it further and remedy its defects. This Mr. Shafer does not attempt to do. We are, therefore, reduced to asking him one or two quite simple and direct questions as to his judgment of facts.

1. Is it not a fact that the advance of science in the last three or four centuries has, on the whole, led to an enormous alleviation of human suffering and an increase in the capacity and the facilities for happiness?

2. Has not this advance been accompanied by a growth in the collective consciousness of mankind, quite unparalleled in history? And is not this growth in the sense of " humanity " due, partly to the knitting up of the world by the mechanical application of science, partly to the fact that science is in itself a social thing and that its growth involves the co-operation of multitudes of minds bent on the whole—poison gas and weapons of war notwithstanding—towards increasing human welfare?

3. If this is so, is it an evil or mischievous thing to try to realise these forces in the world and to feel that they are with us in our individual efforts to promote the same great ends?

It should be noticed that Mr. Shafer in his criticism of Mr. Marvin quotes exclusively from the two books mentioned above, which are rather popular summaries of great epochs of history, and does not refer to the more philosophic treatment of the same topics in the various volumes of the " Unity " series published by the Oxford University Press.

Our Bookshelf.

The Union of South Africa. Department of Mines and Industries. The Geology of the Country around Heidelberg; Geological Map of the Country around Heidelberg. By Dr. A. W. Rogers. Pp. 84. (Pretoria: The Government Printing and Stationery Office.) 8*s.* 6*d.* net, including map.

The publication of the official description of the geology of the Heidelberg district has been anticipated with much interest by South African geologists. The main features of the area have long been known on account of the economic importance of the Nigel Reef. Mainly owing to the pioneer work of Dr. Hatch, it was recognised more than twenty years ago that the Heidelberg district forms the south-eastern limb of the great pitching syncline, on the northern limb of which lies the Rand, and it may at once be said that the result of the detailed survey fully confirms the accuracy of Dr. Hatch's general conclusions. The gradual extension of mining towards the East Rand and the sinking of many bore-holes, some of great depth, have clearly shown that the Nigel Reef belongs to the Main Reef series of the Witwatersrand; it is also shown that the whole Witwatersrand system decreases regularly in thickness towards the south and east, from about 25,000 feet near Johannesburg to 15,000 feet at Heidelberg. This is quite in consonance with the theory of its formation as the delta of rivers coming from an old land to the north-west.

In this memoir the structure of the district is lucidly described. The most remarkable feature is the great Sugarbush fault, so called from its relation to the Zuikerboschrand. This is a new discovery of great importance. The fault is apparently nearly vertical, with a down-throw to the south; at one point in its course, where it brings the Ventersdorp Amygdaloid against the Hospital Hill Series, the throw must be at least 16,000 feet. It therefore ranks as one of the world's greatest dislocations. The fault is certainly of pre-Karroo date, but its relation to the Pretoria Series has not been made out. Probably, however, it was later in date than the deposition of the whole of the Transvaal system, and therefore possibly of early or middle Palæozoic age.

R. H. Rastall.

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